TEST PROCEDURE

PART NUMBER 4391-001
REVISION P
DESCRIPTION ASSY.. WATTMETER. RF POWER ANALYST

OPN NO.	STEP NO.	WORK CNTR #	OPERATION DESCRIPTION
1	1	3-2	EQUIPMENT REQUIRED. 1.) COMPUTER TEST STAND. 2.) TEST FIXTURE (F1-4381-001). 3.) AUX. SKETCH 4391-001 (FIG. A).. IF THE UNIT TO BE TESTED HAS THE 832 OPTION. THEN ADD THE FOLLOWING TO THIS LIST OF REQUIRED EQUIPMENT.. 1.) 832 TEST FIXTURE. 2.) 832 INTERFACE TEST CABLE. 3. SET UP EQUIPMENT AS SHOWN IN FIG. "A" OF AUX. SKETCH 4391-001.. IF THE UNIT TO BE TESTED HAS THE 832 OPTION THEN CONNECT 832 TEST FIXTURE AND INTERFACE TEST CABLE AS SHOWN IN AUX. SKETCH 4391-832 TO UNIT TO BE TESTED.. CONNECT AC POWER AS NEEDED AND TURN ON POWER..
	2		SELECT PROGRAM #9. 4391 FINAL ASSY. TEST. AND FOLLOW TEST PROCEDURE AS SHOWN ON DISPLAY TERMINAL OF COMPUTER TEST STAND.. NOTE: OBSERVE THAT THE READINGS ON BOTH THE UNIT UNDER TEST AND THE TEST FIXTURE ARE IDENTICAL IF THE 832 OPTION IS BEING TESTED..
	3		EQUIPMENT REQUIRED. ----------.. 1.) HP 8656B FREQ. SYNTHESIZER OR EQUIVALENT. 2.) AR 10W1000 RF PWR AMP OR EQUIVALENT. 3.) BIRD LOW PASS FILTER 5451G OR EQUIVALENT. 4.) CALIBRATED POWER STANDARD. 5.) ADJUSTABLE 10B ELEMENT. 6.) 30 MICROAMP METER AND CALIBRATED LINE SECTION. 7.) AUXILIARY SKETCH 4391-001 (FIGURES B THRU D)..

TEST PROCEDURE

PART NUMBER 4391-001
REVISION P
DESCRIPTION ASSY.. WATTMETER. RF POWER ANALYST

OPN NO.	STEP NO.	WORK CNTR #	OPERATION DESCRIPTION
	4		SET UP EQUIPMENT AS SHOWN IN FIG. B OF AUX. SKETCH 4391-001. SET FREQUENCY SYNTHESIZER TO 100 MHz. NO MODULATION.. APPLY 8W ACTUAL POWER TO 30 MICROAMP METER. ADJUST THE 10B CALIBRATION ELEMENT SO THAT THE METER READS EXACTLY 8 WATTS..
	5		REMOVE RF POWER AND METER STANDARD AND REPLACE WITH 4391 TO BE TESTED. INSERT THE ADJUSTED 10B CAL. ELEMENT INTO THE FWD SOCKET AND A DUST PLUG INTO RFL SOCKET (FIG. C).. SET RANGE SWITCHES TO "10" AND "X1" POSITIONS.. TURN UNIT ON..
	6		APPLY 8W ACTUAL POWER TO THE 4391.. DEPRESS THE "FWD CW" BUTTON. THE DISPLAY SHOULD READ 7.6 TO 8.2 WATTS. IF NOT. THE UNIT SHOULD BE TAGGED ACCORDINGLY AND REJECTED.. NOTE: MOST LIKELY THE PROBLEM IS WITH THE LINE SECTION.. REFER TO FIG. E AND ADJUST CAL. POT TO BRING THE READING AS CLOSE AS POSSIBLE TO 8.00 W.. NOTE: MAKE SURE FORWARD ELEMENT IS STILL SEATED PROPERLY..
	7		REMOVE RF POWER.. PLACE THE 10B ELEMENT IN THE "RFL" SOCKET AND A DUST PLUG IN THE "FWD" SOCKET PER FIG. D.. APPLY 8W. ACTUAL POWER TO THE 4391. PRESS "RFL CW"

TEST PROCEDURE

PART NUMBER 4391-001
REVISION P
DESCRIPTION ASSY.. WATTMETER. RF POWER ANALYST

OPN NO.	STEP NO.	WORK CNTR #	OPERATION DESCRIPTION
			BUTTON. THE DISPLAY SHOULD READ .78 TO .82 WATTS. IF NOT. THE UNIT SHOULD BE TAGGED ACCORDINGLY AND REJECTED..
			NOTE: MOST LIKELY THE PROBLEM IS WITH THE LINE SECTION..
	8		REMOVE RF POWER..

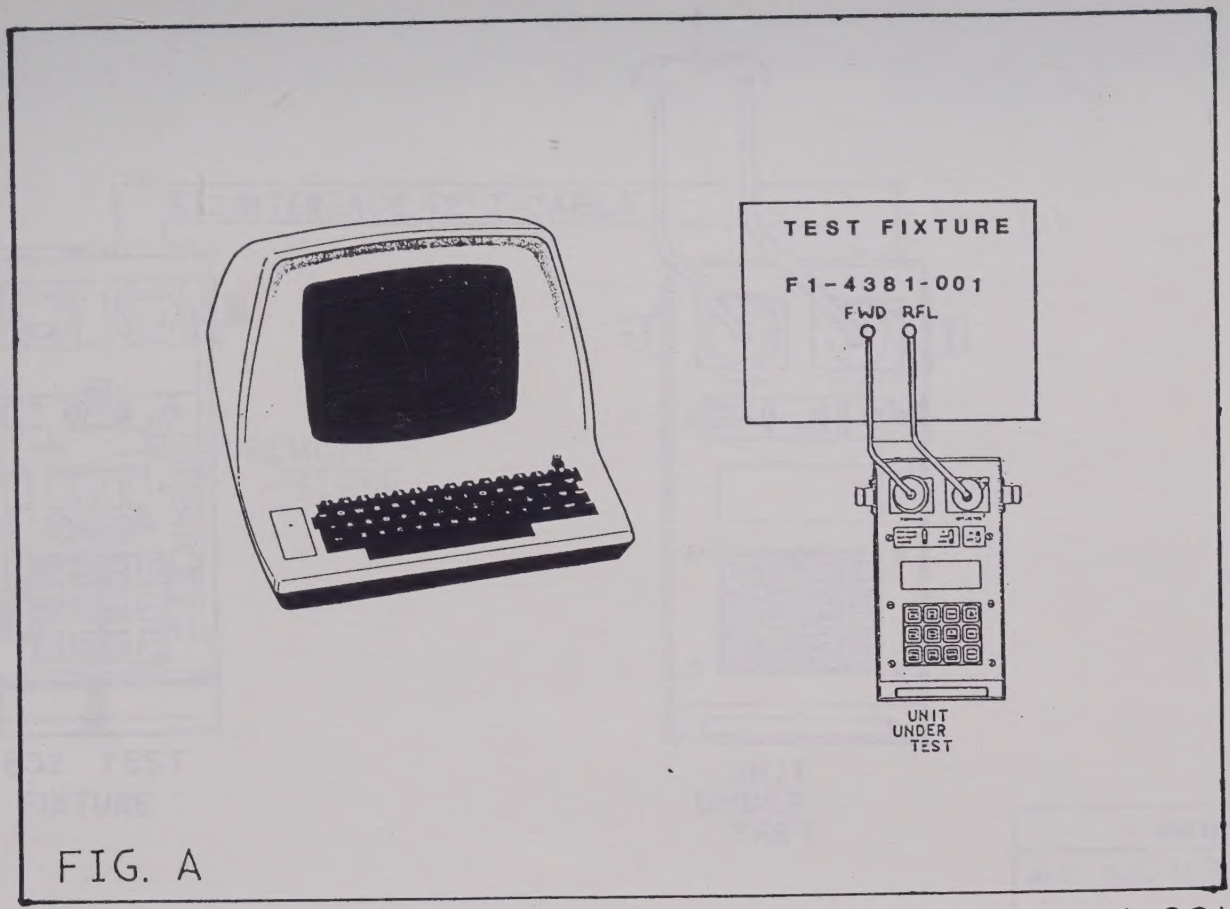
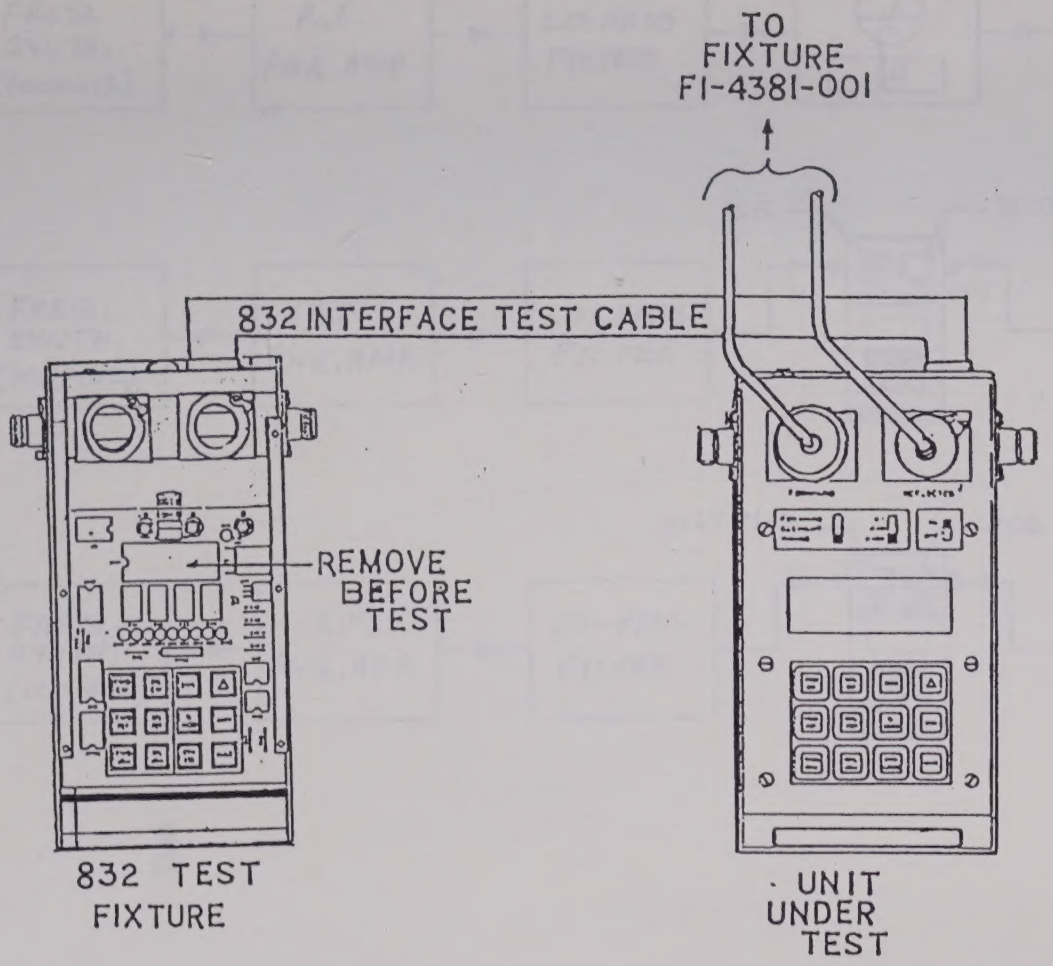
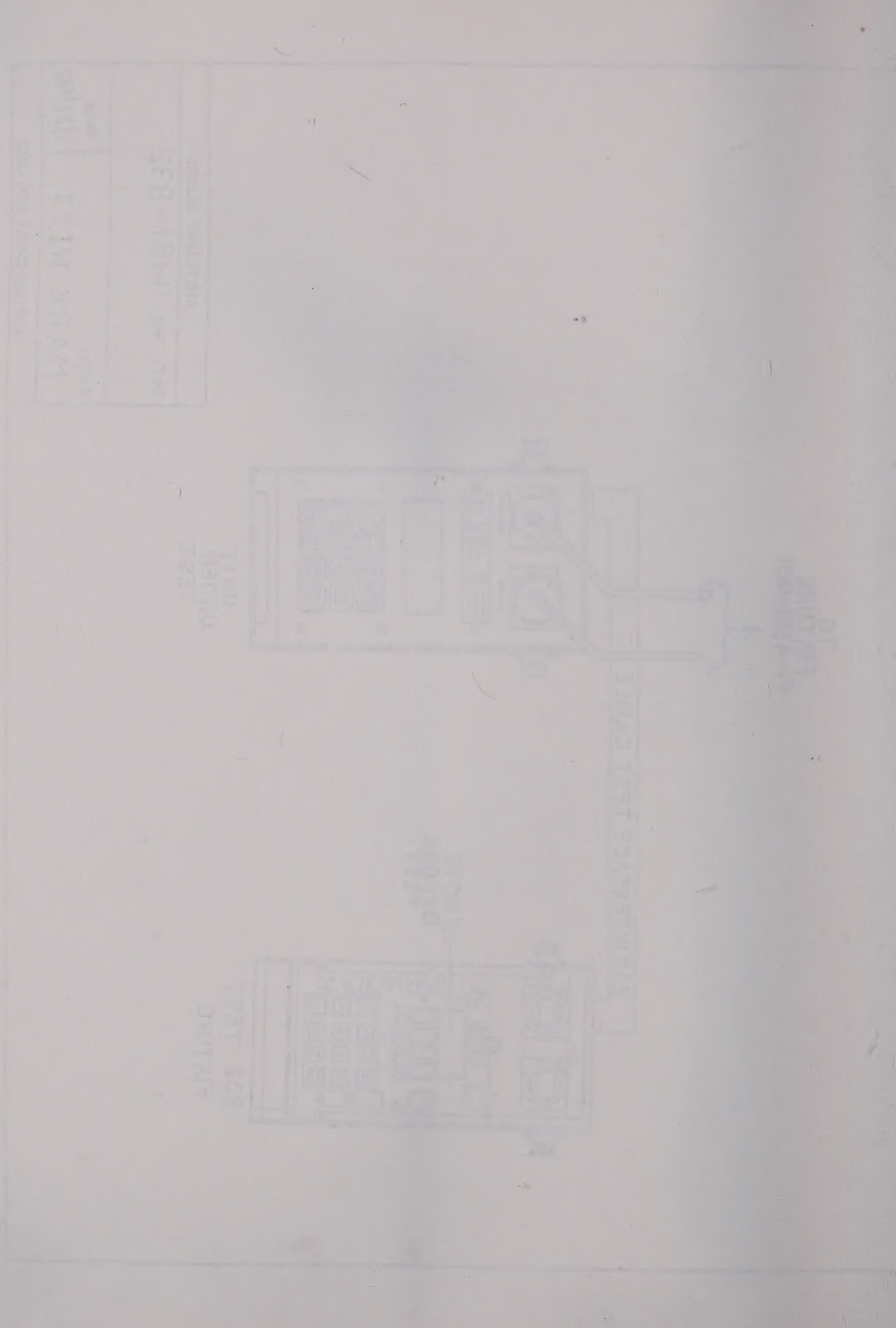


FIG. A

AUXILIARY SKETCH 4391-001



AUXILIARY SKETCH	
Ref. Dwg. 4381-832	
Auth. MARK WITT	Date 3/21/90
FOR ASSEMBLY USE ONLY	



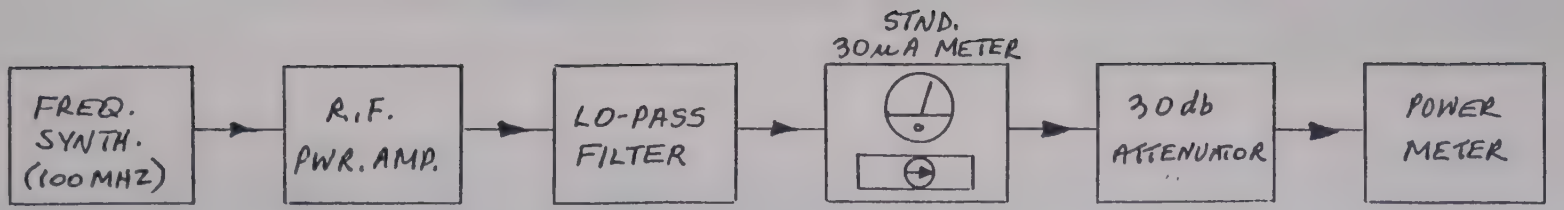


FIG. C

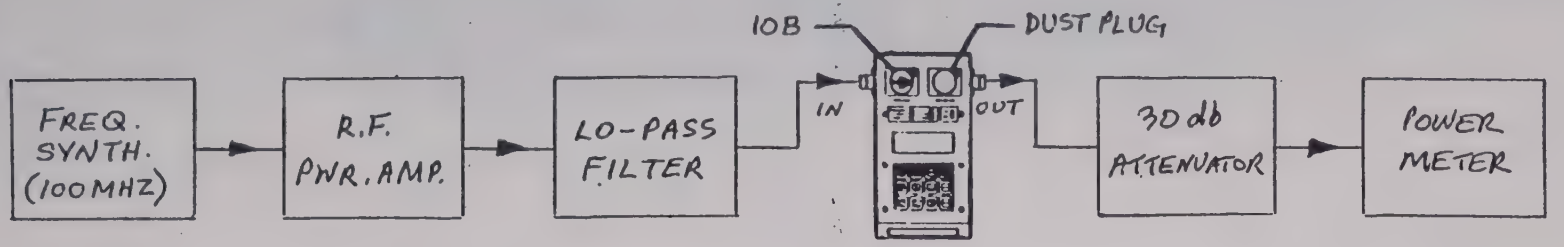
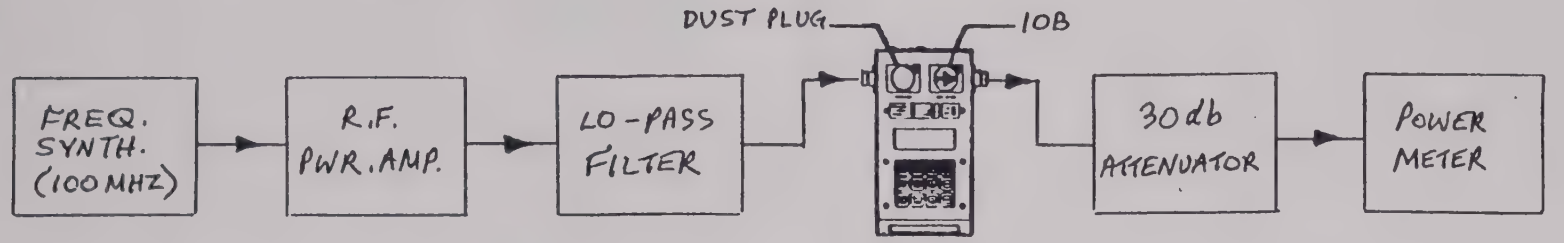
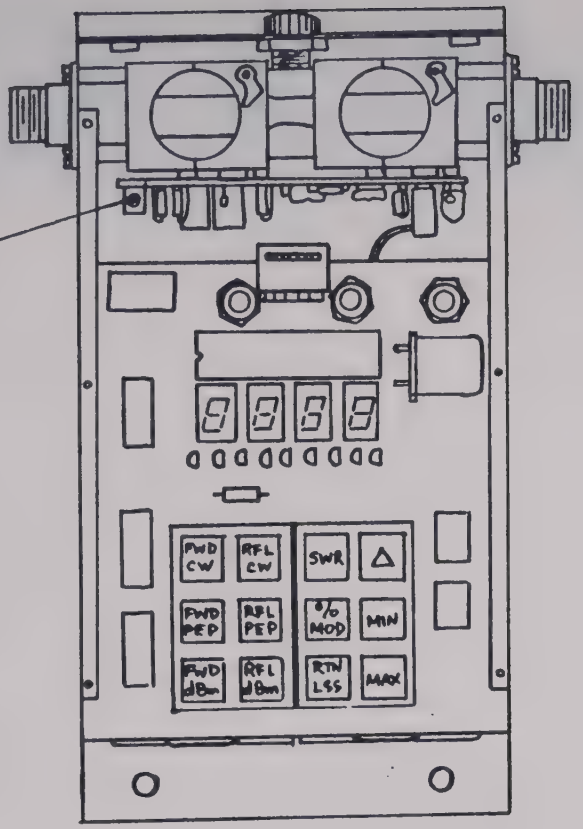


FIG. D



AUXILIARY SKETCH	
Ref. Dwg. 4391-001	
Auth. By	Date 7/15/88
FOR ASSEMBLY USE ONLY	

FIG. E



TOP VIEW

AUXILIARY SKETCH	
Ref. Dwg. 4391-001	
Auth. By D. Amiens	Date 7/15/88
FOR ASSEMBLY USE ONLY	

TEST DATA RECORD

MODEL TYPE 4391 PART NUMBER 4391-001

TEST DATE _____ SERIAL NUMBER _____

TEST NUMBER	TEST DESCRIPTION	TEST PARAMETERS MIN	TEST PARAMETERS MAX	INDICATED VALUE	TEST COMMENTS
01	Power up indication	0	0		
02	Display segment check	none	none		Check functionality of all display segments.
05	Forward CW	990	1010		
10	Reflected CW	29.4	30.6		
15	VSWR	1.41	1.43		
20	Delta	none	none		Check left & right facing arrows " ", " ".
25	Forward PEP	49.0	51.0		
30	Reflected PEP	1.45	1.55		
35	% modulation	70.0	80.0		
40	Forward DBM	32.3	32.5		
45	Reflected DBM	20.8	21.1		
50	Return loss	11.2	11.7		
55	Min.	.049	.051		
60	Max.	.245	.255		
					Test Complete

SECTION V - REPLACEMENT PARTS LIST

5-1. GENERAL

5-2. The parts listed in this section are those recommended for replacement by the manufacturer. Do not disassemble beyond the instructions of Section IV - Maintenance, since replacement parts other than those described are not available.

MODEL 4391 REPLACEMENT PARTS LIST

QUANTITY	DESCRIPTION	PART NUMBER
1	Line section (less PC board)	4381-005
6	Batteries (rechargeable) "C" cell	5-1230
1	Battery holder	4391-019
1	Velcro strap	5-1958
2	Keyboard module	5-1277
1	Keyboard legend	4386-012
3	SPDT toggle switch	5-1327
4 (DS1-DS4)	LED display	5-1337
1	Display bezel	4381-060
1	Red filter	4381-061
6	Pushnut	5-1076-2
1	Bail	4381-012
1	Power line filter	5-1585
1	Fuse holder	5-1326
1	Fuse 1/8 A, 250 Vac	5-721-8
1	Slide switch	5-1088
1	Transformer	5-1276
1	Transformer assy., (includes rectifier circuit)	4391-020
1	PC board assembly (on line section)	4391-005
1 (UO1)	OP amp wideband	5-1330
2 (UO2, UO3)	Voltage comparator	5-1328
1 (UO4)	Micropower OP amp	5-1332
2 (UO5, UO6)	Analog multiplexer	5-1333
1 (UO7)	Analog-to-Digital converter	5-1217
2 (CRO1,CRO2)	Diode	5-553
1	PC board processor assembly	4391-007
9 (QO1-QO9)	Transistor (2N3906)	5-1090
1 (UO8)	NAND gate (74LS00)	5-1219
1 (UO9)	I.D. microcomputer	4381-035
1 (U10)	Driver decoder	5-1220
1 (U11)	Voltage regulator (5 volt)	5-1100-1
1 (U12)	Voltage converter (5 volt)	5-1331
1 (U13)	Positive regulator (3 term)	5-1334-1
1 (U14)	Voltage comparator	5-1267
1 (X1)	Microporcessor crystal	5-1214
1	Socket connector assembly	4391-021
1	Power cord, 115 V	5-1286
1	Power cord, 230 V	5-1287
1	I/O cable assembly	4380-514

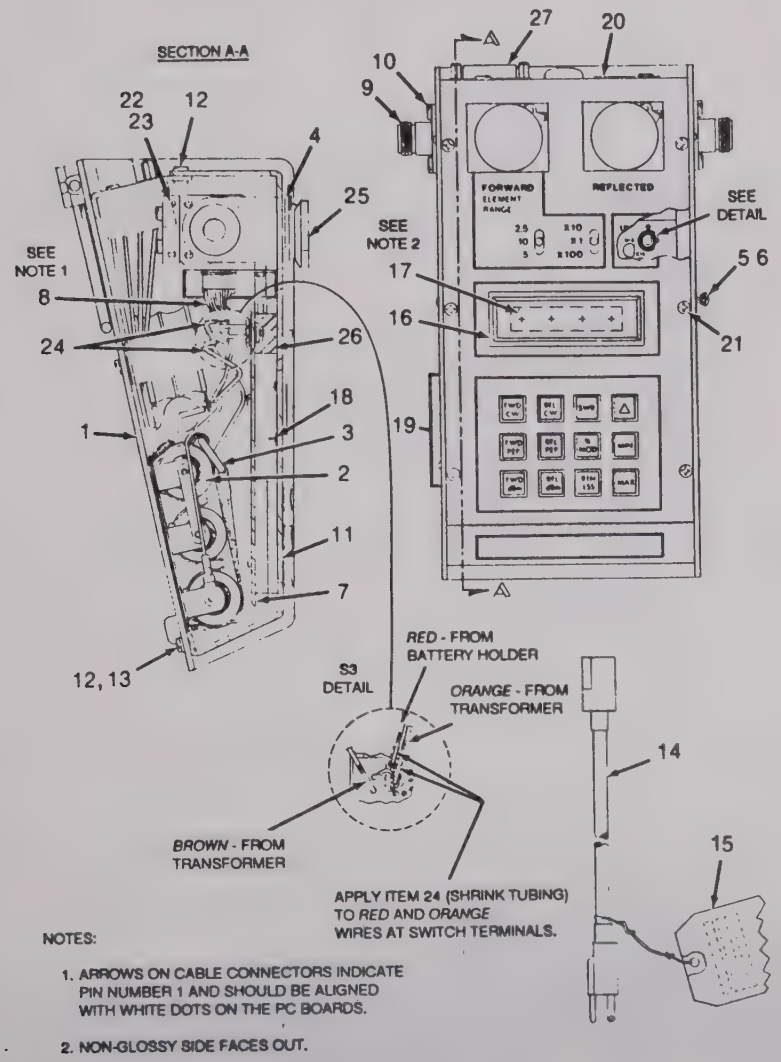
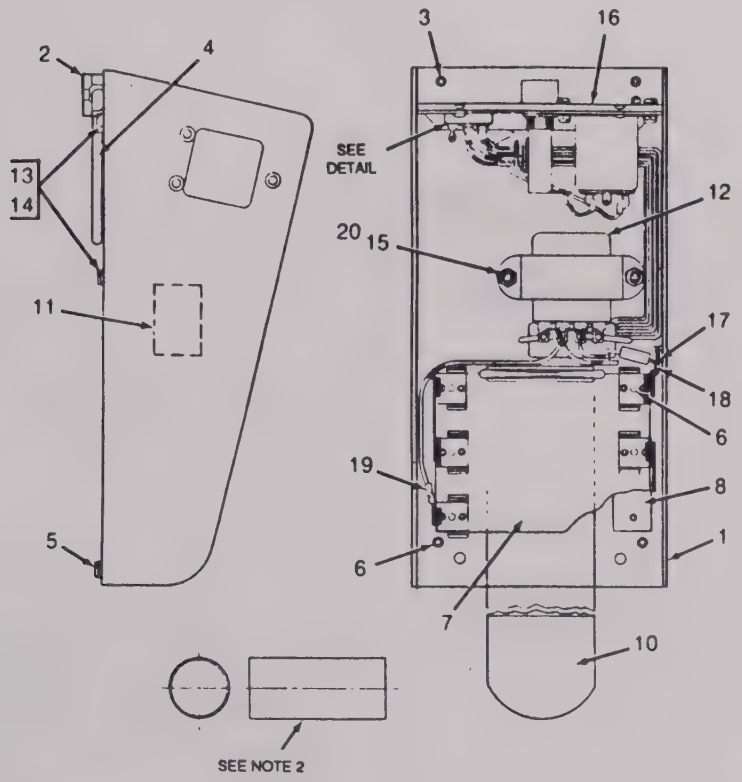


Figure 5-1. RF Power Analyst, Model 4391M

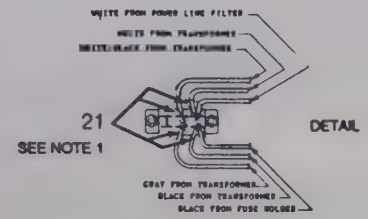
LEGEND FIGURE 5-1

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-1	RF POWER ANALYST, Model 4391M .	70998	4391-061	REF
-1	. RF POWER ANALYST, Subassembly (See Fig. 5-2 for breakdown.)	70998	4391-002	1
-2	. BATTERY, Rechargeable, C-cell ...	2M734	P-180C	6
-3	. Not Used			
-4	. LINE SECTION, Assembly ..... (See Fig. 5-5 for breakdown.)	70998	4391-064	1
-5	. SCREW, Machine, phillips oval .... head, #4-40, 1/4 in. lg, sst		COML	6
-6	. LOCKWASHER, External tooth, ... countersunk #4, sst		COML	6
-7	. PC BOARD, MCU, Assembly ..... (See Fig. 5-7 for breakdown.)	70998	4391-068	1
-8	. CABLE, PC board, Assembly	30146	5102497	1
-9	. CONNECTOR, Female N, Assembly	70998	4240-062	2
-10	. SCREW, Machine, #8-32, ... 1/4 in. lg, pan head, sst		COML	8
-11	. PANEL, Assembly	70998	4391-066	1
-12	. SCREW, Machine, pan head #6-32, 5/16 in. lg, sst		COML	4
-13	. LOCKWASHER, Internal tooth, ... #6, sst		COML	2
	. CABLE, Power cord, 115/230V, ... Assy	70998	4421-055	1
-14	. . CORD, Power supply	70903	17250	1
-15	. . TAG, 230V operation	70998	5-1792	1
-16	. BEZEL, Display, molded	70998	4381-060	1
-17	. FILTER, Red	70998	4381-061	1
-18	. FASTENER, Push nut	77122	PS 094032	6
X -19	. LABEL, RF Directional Wattmeter ..	70998	4300B306-1	1
-20	. LABEL, Serial number ..... (Specify serial number.)	70998	4381-063	1
-21	. SCREW, Machine, phillips pan .... head, #4-40, 1/4 in. lg, sst		COML	6
-22	. LOCKWASHER, Internal tooth, ... #4, sst		COML	4
-23	. SCREW, Machine, pan head, #4-40, 1/4 in. lg, sst		COML	4
-24	. TUBE, Shrink, 1/8" ID, 1/2" lg	92194	FIT-221	2
-25	. PLUG, Dust	70998	3610-031-1	2
X -26	. PAD	70998	~~5-1498~~ 5-1948	3
-27	. CABLE, I/O, Assembly	70998	4380-514	1



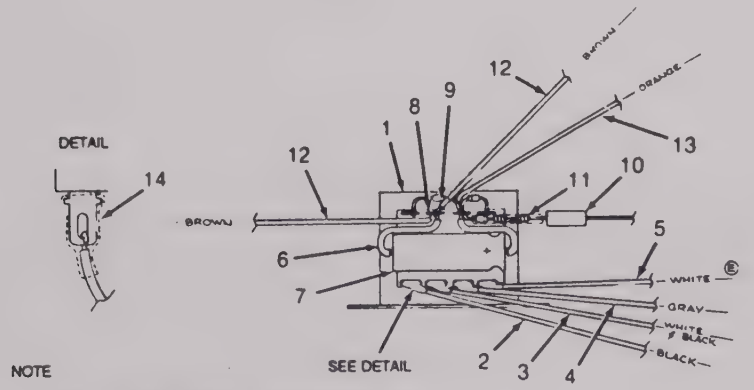
NOTES:

1. INSTALL HEAT SHRINK TUBING (ITEM 21) OVER WIRES BEFORE SOLDERING.
2. BATTERY TUBES MUST ACCOMPANY THIS ASSEMBLY.



LEGEND FIGURE 5-2

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-2	RF POWER ANALYST, Subassembly .	70998	4391-002	REF
	. HOUSING, Assembly	70998	4391-004	1
-1	. . HOUSING, Lower	70998	4391-022	1
-2	. . FOOT, Detent	70998	4381-013	2
-3	. . RIVET, Tubular	70998	5-442-10	4
-4	. . BAIL, Tilt	70998	4381-012	1
-5	. . BUMPER, Foot	70485	1308W	2
-6	. . RIVET, Tubular	70998	5-442-9	8
-7	. . HOLDER, Battery, Assembly	70998	4391-019	1
-8	. SPACER, Battery holder	70998	4391-037	2
-9	. Not Used			
-10	. STRAP, Velcro	70998	5-1958	1
-11	. . LABEL, Computing devices, mylar	70998	4381-064	1
-12	. TRANSFORMER, Assembly ..... (See Fig. 5-3 for breakdown.)	70998	4391-020	1
-13	. SCREW, Machine, pan head, ... #6-32, 5/16 in. lg, sst		COML	4
-14	. LOCKWASHER, Internal tooth, ... #6, sst		COML	4
-15	. LOCKNUT, Elastic, #6-32, sst		COML	2
-16	. PANEL, Rear, Assembly ..... (See Fig. 5-4 for breakdown.)	70998	4391-017	1
-17	. WIRE, Electrical, stranded ..... #22GA., red vinyl insul.		COML	1
-18	. TUBE, Shrink, 1/4" ID, 1" lg	92194	FIT-221	1
-19	. TUBE, Shrink, 3/16" ID, 1/2" lg	92194	FIT-221	1
-20	. WASHER, Flat, #6, sst		COML	2
-21	. TUBE, Shrink, 1/8" ID, 1/2" lg	92194	FIT-221	4

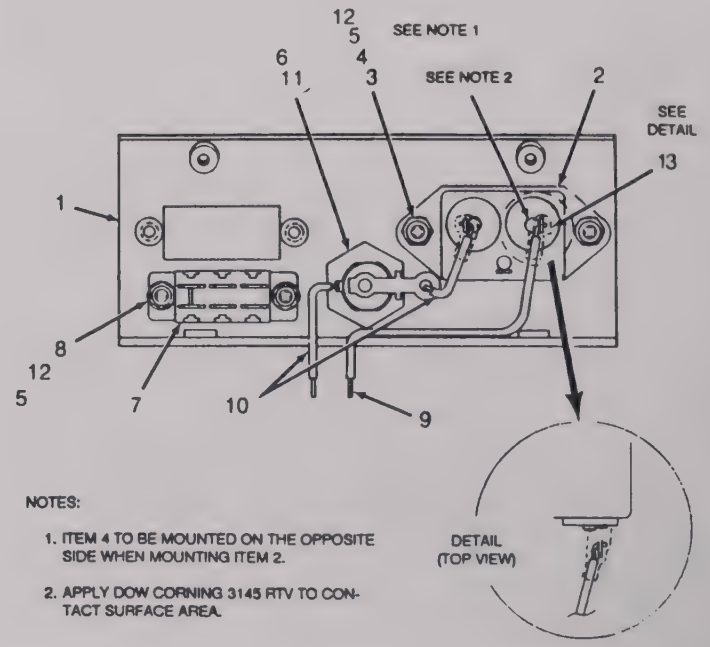


NOTE

1. APPLY A LARGE AMOUNT OF DOW CORNING 3145 RTV UNDER CAPACITOR, ITEM 7, TO SECURE IN PLACE.

Figure 5-3. Transformer Assembly

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-3	TRANSFORMER, Assembly	70998	4391-020	REF
-1	. TRANSFORMER	08779	DP241-5-16	1
-2	. WIRE, Electrical, stranded tinned, . . #22GA., black vinyl insul.		COML	1
-3	. WIRE, Electrical, stranded tinned, . . #22GA., black/white vinyl insul.		COML	1
-4	. WIRE, Electrical, stranded tinned, . . #22GA., gray vinyl insul.		COML	1
-5	. WIRE, Electrical, stranded tinned, . . #22GA., white vinyl insul.		COML	1
-6	. TUBING, Vinyl, 5/64" OD, 1" lg	9A204	#16 TEMFLEX 105	2
-7	. CAPACITOR, Electrolytic, axial, ... 3300uF (C11)	55680	TVX1C332M	1
-8	. TERMINAL, Transformer	05616	202	1
-9	. DIODE, Rectifier (CR3, CR4, CR5) .	14936	1N4002	3
-10	. RESISTOR, 22 ohms, 5%, 1W (R16)	01121	RCR32	1
-11	. TUBING, Shrinkable, teflon, 1" lg . . .	92194	FIT-400-9	1
-12	. WIRE, Electrical, stranded . . . . . #22GA., brown vinyl insul.		COML	1
-13	. WIRE, Electrical, stranded . . . . . #22GA., orange vinyl insul.		COML	1
-14	. TUBE, Shrink, 3/16" ID, 1/2" lg	92194	FIT-221	4



NOTES:

1. ITEM 4 TO BE MOUNTED ON THE OPPOSITE SIDE WHEN MOUNTING ITEM 2.
2. APPLY DOW CORNING 3145 RTV TO CONTACT SURFACE AREA.

Figure 5-4. Rear Panel Assembly

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-4	PANEL, Rear, Assembly	70998	4391-017	REF
-1	. PANEL, Rear	70998	4391-023	1
-2	. FILTER, Power line	05245	~~1EF1~~	1
-3	. SCREW, Machine, pan head, ... #4-40, 7/16 in. lg, sst		COML	2
-4	. LOCKWASHER, Internal tooth, ... #4, sst		COML	2
-5	. LOCKNUT, Elastic, #4-40, sst		COML	4
-6	. FUSEHOLDER, Panel, 3AG, ...	75915	~~341-001-AL~~	1
-7	. SWITCH, Slide, locking, DPDT (S4) .	82389	46256LFR	1
-8	. SCREW, Machine, pan head, ... #4-40, 5/16 in. lg, sst		COML	2
-9	. WIRE, Electrical, stranded tinned . . . #22GA., white vinyl insul.		COML	1
-10	. WIRE, Electrical, stranded tinned . . . #22GA., black vinyl insul.		COML	2
-11	. FUSE, 3AG, 1/8 amp 250 volt (F1) . .	75915	313.125	1
-12	. WASHER, Type B, flat, #4, sst		COML	4
-13	. TUBE, Shrink, 1/8" ID, 1/2" lg	92194	FIT-221	2

Figure 1. Line Section Assembly

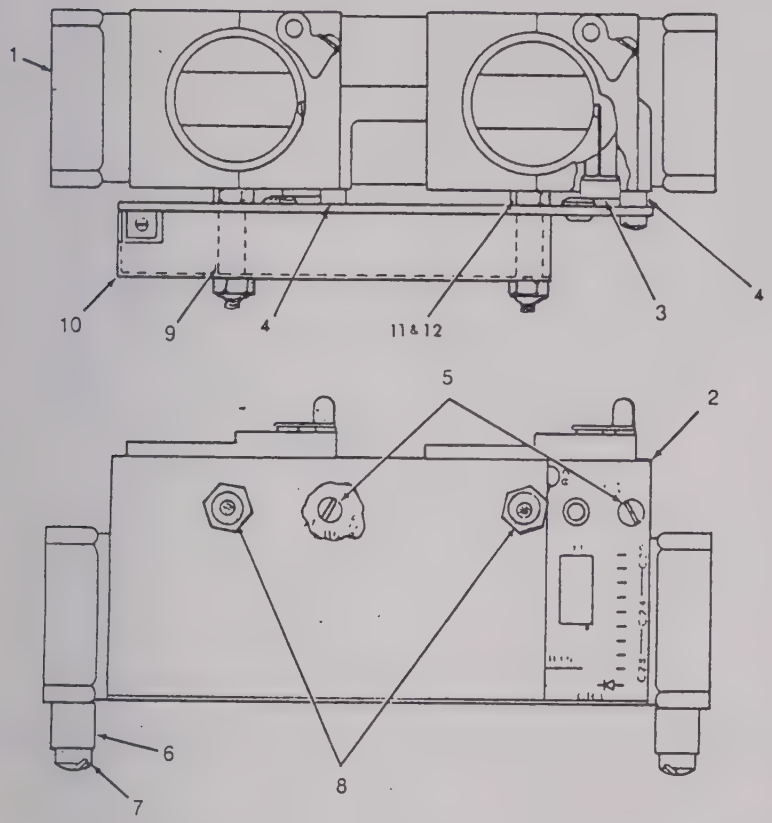


Table 1. Parts List

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-5	LINE SECTION, Assembly	70998	4391-064	REF
-1	. LINE SECTION, Subassembly	70998	4391-065	1
-2	. PC BOARD, Data Acquisition Assy .. (See Fig. 5-6 for breakdown.)	70998	4391-062	1
-3	. BEAD, Keying	70998	4391-026	2
-4 *	. SPACER	70998	4391-027	2
-5	. SCREW, Machine, fillister head, ... #4-40 x 1/4, sst		COML	2
-6	. SUPPORT	70998	4381-029	2
-7	. SCREW, Machine, fillister head, ... #8-32 x 1/2, sst		COML	4
-8 *	. HEX NUT With nylon insert.... #4-40 sst		COML	2
-9	. SPACER	70998	4391-035-1	2
-10	. COVER, PC Board	70998	4391-034	1
11*	. LOCKWASHER #4 INTERNAL TOOTH		COML	2
12*	. STANDOFF, THREADED	70998	4391-038	2

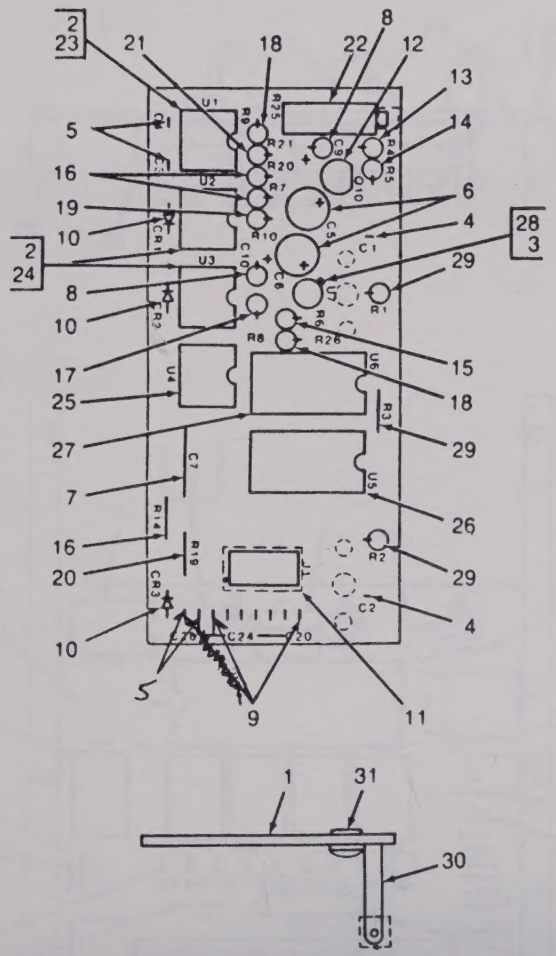
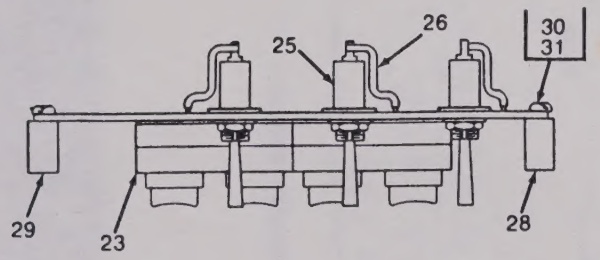


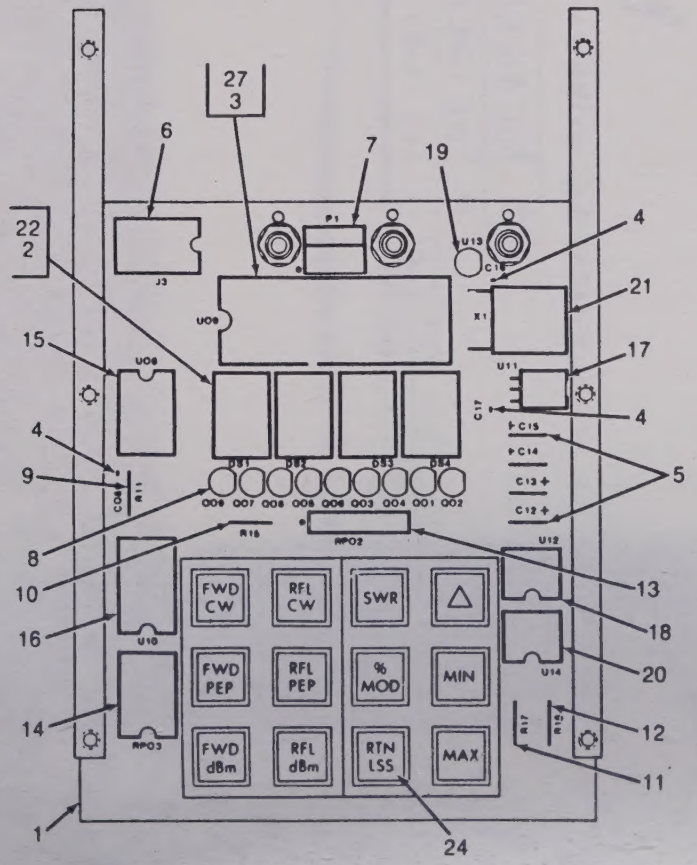
Figure 5-6. Data Acquisition PC Board

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-6	PC BOARD, Data Acquisition	70998	4391-062	REF
	. PC Board, Subassembly	70998	4391-006	1
-1	. . PC BOARD, Aquisition	70998	4391-010	1
-2	. . PAD, Mounting	32559	808-187	3
-3	. . SPACER, TO-18 Mount	32559	109-045	1

LEGEND FIGURE 5-6 - Continued

INDEX NO.	DESCRIPTION 1 2 3 4 5 6 7	CAGE CODE	MFG. PART NO.	QTY
5-6	PC BOARD, Data Acquisition - Cont'd			
	. PC Board, Subassembly - Cont'd	20734	ECEA1VU101	
-6 X	. . CAPACITOR, Electrolytic, 100uF, 20% (C5, C6)	~~64813~~	~~RE-16V-101M~~	2
-7	. . CAPACITOR, Polypropylene, ... 2200pF (C7)	74861	PP11.0022-1605	1
-8	. . CAPACITOR, Electrolytic, 2.2uF .. 2.2uF (C9, C10)	01884	150D225X 90-15A2	2
-9 X	. . CAPACITOR, Ceramic, 1000pF, .. -0/+100% (C20 thru ~~C26~~ C26)	59660	TYPE SM	9
-10	. . DIODE (CR1 thru CR3)	15238	1N4148	3
-11	. . HEADER, Male, I/O Pin	63878	929836-01	1
-12	. . TRANSISTOR, PNP (Q10)	27014	2N3906	1
-13	. . RESISTOR, 2.2M ohms, 5%, ... 1/4W (R4)	01121	TYPE CB	1
-14 X	. . RESISTOR, ~~9.09K~~ ohms, 1%, ... 1/8W (R5) 3.01K	91637	RN55D	1
-15	. . RESISTOR, 3.32K ohms, 1%, ... 1/8W (R6)	91637	RN55D	1
-16	. . RESISTOR, 1.0K ohms, 10%, 1/4W (R7, R14, R20)	01121	TYPE CB	3
-17	. . RESISTOR, 470 ohms, 2%, ... 1/4W (R8)	70998	5-546-3	1
-18	. . RESISTOR, 10M ohms, 5%, 1/4W (R9, R26)	01121	TYPE CB	2
-19	. . RESISTOR, 5.6M ohm, 10%, ... 1/4W (R10)	01121	TYPE CB	1
-20	. . RESISTOR, 10K ohms, 10%, ... 1/4W (R19)	01121	TYPE CB	1
-21	. . RESISTOR, 150 ohms, 5%, ... 1/4W (R21)	01121	TYPE CB	1
X -22	. . POTENTIOMETER, Cermet trimmer, 100K ohms (R25)	01121	94P~~1~~04	1
-23	. . INTEGRATED CIRCUIT, OP Amp (U1)	27014	LF257H	1
-24	. . INTEGRATED CIRCUIT, Voltage .. comparator (U2, U3)	27014	LM211H	2
-25	. . INTEGRATED CIRCUIT, OP Amp, . dual (U4)	18722	CA3240E	1
-26	. . INTEGRATED CIRCUIT, Analog ... multiplexer (U5)	27014	4052B	1
-27	. . INTEGRATED CIRCUIT, Analog ... multiplexer (U6)	27014	4051B	1
-28	. . INTEGRATED CIRCUIT, Precision . voltage reference (U7)	27014	LM113H	1
-29	. RESISTOR, 1.4K ohm, 1%, 1/8W ... (R1 thru R3) must be replaced as a matched set.)	91637	RN55D	3
-30	. CONTACT, DC	70998	4381-007	2
-31	. EYELET, Silver	57771	GS 5-5	2





LEGEND FIGURE 5-7

INDEX NO.	DESCRIPTION 1234567	CAGE CODE	MFG. PART NO.	QTY
5-7	PC BOARD, MCU, Assembly	70998	4391-068	1
	. PC BOARD, MCU, Subassembly	70998	4391-063	1
	.. PC BOARD, MCU, Subassembly	70998	4391-008	1
-1	... PC BOARD, MCU	70998	4391-011	1
-2	... SOCKET, Low profile, DIP, 14 Pin	~~09779~~	~~640357-1~~	4
-3	... SOCKET, Low profile, 40 pin DIP	00779	640379-1	1
-4	... CAPACITOR, Ceramic, 0.1uF, 20% (C08, C16, C17)	72982	RPE121Z5U 104M	3
-5	... CAPACITOR, 10uF (C12 thru C15)	31433	T322C106M0 15AS	4
-6	... SOCKET, Low profile, DIP (J3)	~~09779~~	~~640357-1~~	1
-7	... HEADER, Male, right angle (P1)	70998	4391-030	1
-8	... TRANSISTOR PNP (Q1 thru Q9)	27014	2N3906	9
-9	... RESISTOR, 1M ohm, 5%, 1/4W (R11)	01121	TYPE CB	1
-10	... RESISTOR, 150 ohm, 5%, 1/4W (R15)	01121	TYPE CB	1
-11	... RESISTOR, 4.02K ohm, 1%, 1/8W (R17)	91637	RN55D	1
-12	... RESISTOR, 10K ohm, 1%, 1/8W (R18)	91637	RN55D	1
-13	... RESISTOR NETWORK, 4.7K ohm, SIP (RP2)	32997	4308R-102-472	1
-14	... RESISTOR NETWORK, 100 ohm, DIP (RP3)	32997	4114R-001-101	1
-15	... INTEGRATED CIRCUIT, NAND Gate, quad (U8)	27014	74LS00	1
-16	... INTEGRATED CIRCUIT, Decoder/ driver, seven segment (U10)	27014	7447A	1
-17	... INTEGRATED CIRCUIT, Voltage regulator (U11)	27014	LM340T5	1
-18	... INTEGRATED CIRCUIT, Voltage converter, CMOS (U12)	32293	ICL7660CPA	1
-19	... INTEGRATED CIRCUIT, Voltage regulator (U13)	27014	LM340LAZ-5.0	1
-20	... INTEGRATED CIRCUIT, Voltage comparator (U14)	27014	LM311N	1
-21	... CRYSTAL, Microprocessor, 2.00 MHz (X1)	2U635	MPC33	1
-22	.. DISPLAY, LED (DS1 thru DS4)	50434	5082-7610	4
-23	.. SWITCH, Pushbutton (S5)	81073	82-601-81	2
-24	.. LEGEND, Keyboard	70998	4386-012	1
-25	.. SWITCH, Toggle, SPDT (S1 thru S3)	09353	7103-L2Y-ZQ	3
-26	.. WIRE, Electrical, #22GA., solid copper 0.060 in. dia., yellow PVC insul., 1 in. long		COML	7
-27	. INTEGRATED CIRCUIT, Masked Microprocessor, NMOS (U9)	70998	4381-035	1
-28	. SUPPORT, PC Board	70998	4391-024	1
-29	. SUPPORT, PC Board	70998	4391-025	1
-30	. SCREW, Machine, pan head, #4-40, 1/4 in. lg, sst		COML	4